C·R·E·S®
CENTER FOR REPRODUCTION OF ENDANGERED SPECIES

REPORT

SPRING 2000

CRES® is operated by the Zoological Society of San Diego.

One Giant Panda Birth: A Small Cub Signals a Big Event

Mother Bai Yun has proved to be an excellent and attentive mother as she supervises Hua Mei's exploration of the exhibit. The young cub is curious and adventurous, climbing over logs and into trees—and occasionally she needs to be rescued by her vigilant mother!

The first birth of a giant panda cub at the San Diego Zoo in August 1999, and only the sixth to be born in North America, proved to be an exciting confirmation of the value of scientific approaches to reproduction. In this case, the failure of our male, Shi Shi, to respond during Bai Yun's estrus forced us to rely on daily monitoring of the female's behavior and endocrine profiles in order to determine the right timing for artificial insemination. Now as our female cub, Hua Mei, has survived those first worrisome days and is approaching her sixth month of life, we can begin to look at data collected from the moment of birth to further reveal the remarkable biology of the panda. Our catalogue of behaviors changed dramatically as we added both maternal and infant activities to the list, with our observers taking data on an around-the-clock basis for the first two months.

Enough birth weights from other locations are now in hand to establish that giant panda infants, when compared to adult females of average weight, are relatively the smallest of all infants born to placental mammals. Although we did not attempt to obtain a weight at birth, we have collected data from other pandas that indicate that at 112 grams (3.9 ounces) on average, panda infants are about 43 times lighter than one would predict on the basis of the mother's weight. Stated another way, panda mothers are on average between 800 and 900 times heavier than their infants. Why so small? One theory holds that because bamboo is so low in nutritional value, giant pandas are compelled to limit their investment in reproduction by having very small infants along with a number of other traits, such as delayed implantation and slow growth rates. Others have suggested that pandas have a common ancestry with bears, and what we see in the panda is further reduction of a trait shared with bears, perhaps because of the panda's bamboo diet.

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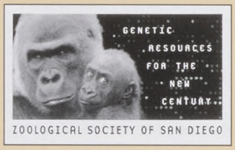
A Memorial Tribute to Arlene Kumamoto
Colleagues remember a scientist and friend.
See page 5.

An Evening with the Conservation Medalists
Dr. Marilyn Renfree and Mr. John Aspinall to be honored on May 12.
See page 4.


GENETIC RESOURCES FOR THE NEW CENTURY
ZOOLOGICAL SOCIETY OF SAN DIEGO

Zoological Society Hosts Conference
Geneticists will meet to discuss resources for the next century.
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One Giant Panda Birth: A Small Cub Signals a Big Event

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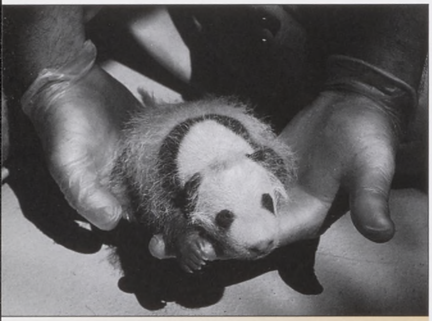


At 22 days old, the young panda cub was still very small and helpless. At birth, she weighed a mere 4 ounces and resembled a white rat, with no black markings visible.

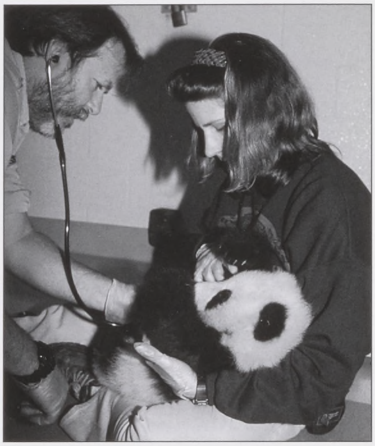
Because they are so small, it is not surprising that panda infants are also highly altricial (underdeveloped) at birth, and initially they must be held to the breast for nourishment and warmth, much in the manner a gorilla mother establishes unbroken neonatal contact during the early weeks of life. Whatever efforts pandas save by having a short gestation and small fetus, they more than make up for during the first weeks of postpartum care of the young. In appearance, the neonate resembled a white rat in both size and color. The body fur was initially sparse, leaving the pink skin to show through. During the third week, the dim outlines of the dark pigmented areas that would later underlie the black markings of the coat became noticeable.

By the 14th day, the first time a weight could be obtained, infant Hua Mei weighed in at 354 grams (an increase from ¼ to about ¾ pounds since birth). At the time you read this article, she will be over five months of age and over 20 pounds in weight. Her eyes did not fully open until after 50 days, in marked contrast to the 2 weeks or so required for puppies and kittens. Panda infants normally rely on mother's milk as the main source of nourishment for most of the first year of life.

As the mother began to leave the birth den for increasingly long periods, we were able to observe changes in Hua Mei's behavior: changes in her activities and in her locomotion. A surprise for us was the difference in forelimb and hindlimb development. At 74 days, Hua Mei could sit up, using the forelimbs for support, and from this posture she began to scoot from point to point within the den. Two more weeks would pass before she could stand on all fours, and nearly two months would pass before she took her first steps. Concerns for neurological deficiency were eventually alleviated, and a videotape of an infant in a Chinese zoo showed a similar lag in hindlimb development.

At 96 days, the mother took Hua Mei out of the den for the first time, using the typical carnivore pattern of grasping the infant's fur in her teeth. Even though Hua Mei was not yet ambulatory, there are records of panda mothers in the wild that forsake birth dens at about this time, carrying their infants from place to place as they forage. By the fourth month, Hua Mei began leaving the den on her own, engaging in short exploratory excursions, and at five months, both mother and infant began the move to the exhibit area. In this location, Hua Mei encounters a diverse terrain, such as a log or a stone, and she spends much of her time repeatedly climbing back and forth over these structures. Every leaf and stem is an item to be smelled, mouthed, or pawed as Hua Mei explores her world.

Looking ahead, we anticipate a separation of the mother and daughter at about 18 months, and a renewed effort at reproduction will occur in the spring of 2001.



The young cub is examined every week by the veterinary and animal care staff at the San Diego Zoo. They are monitoring her growth, vital signs, and motor skills as she continues to thrive.

Should we be successful at that time, our giant panda population will grow to four or possibly even five, in the event of twins, and additional exhibit space will have to be created. As our scientific work goes forward, we are fully cognizant of the fact that time is not our ally as we strive to minimize the impoverishment and damage to our planet, and that even a single, small event—the birth of a giant panda—helps to draw attention to this struggle.

—Donald G. Lindburg, Ph.D.,
Head of Behavior Division/CRES

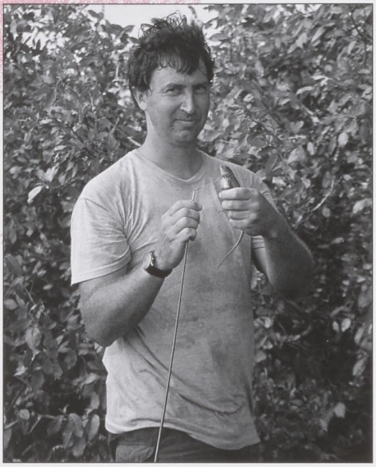
A bamboo stick is just one of the many fascinating objects that Hua Mei encounters as she explores her exhibit.

Ecology and Applied Conservation

We are pleased to welcome two new postdoctoral fellows to the CRES team of conservation scientists this year. In February, Dr. Tracey Brown joined us from the Biology Department at UCLA, where she completed her dissertation research on the ecology and physiology of desert horned lizards in the Mojave Desert at the Fort Irwin army base. Tracey measured the changing food and water needs of the lizards during both drought and nondrought years, and she found that unlike many other ant-eating animals, desert horned lizards do not have unusually low metabolisms. She also helped the U.S. Army assess the effects of desert military training on local reptiles. During her three-year stay at CRES, Tracey will be studying how restoration of native sage scrub plant communities influences the ecology and distribution of San Diego coast horned lizards in the environment. Tracey's work, funded in part by the Metropolitan Water District of Southern California, will involve intensively monitoring habitat use by horned lizards in the Lake Skinner area of southwestern Riverside County via radiotelemetry.

Kathryn Brown

With funding from the Zoological Society of San Diego's Conservation Fund, Dr. Glenn Gerber will join us in April. Glenn's dissertation research, conducted in the Ecology and Evolutionary Biology Department at the University of Tennessee, involved a comparative study of the ecology and behavior of the brown anole lizard, an introduced species, and its effects on native green anoles in Florida and Grand Cayman anoles in the Cayman Islands. As a recipient of a Fulbright Fellowship, Glenn also spent a year studying and helping to develop a recovery plan for two highly endangered subspecies of rock iguanas in the Cayman Islands. For the next three years, Glenn will be carrying out a rescue and restoration program for the critically endangered Turks and Caicos Islands iguana. At present, a third of the remaining individuals of this species inhabit Big Ambergris Cay, an island slated for extensive tourist development. Glenn's work, which will relocate approximately 1,000 iguanas from Big Ambergris to suitable, uninhabited cays in the region, will include long-term ecological studies of restored populations, as well as collaborative veterinary, endocrinological, and nutritional studies with San Diego Zoo staff.



Jeff Lemm

CRES Grants

The Center for Reproduction of Endangered Species is grateful to the following for their support of imperiled wildlife:

The Alice C. Tyler Perpetual Trust has awarded a grant for genetic and endocrinology studies under the direction of Dr. Oliver Ryder, geneticist, and Nancy Czekala, endocrinology specialist, for the conservation of giant pandas, rhinoceroses, and gorillas. **The Armstrong McDonald Foundation** and **The Bay Foundation** recently contributed toward Dr. Barbara Durrant's endangered carnivore studies through the CRES reproductive physiology division. **The Heller Foundation of San Diego** has awarded a Bud Heller Conservation Fellowship to the CRES virology/immunology division for rhinoceros immunology studies. A grant from **The Clovis Foundation** will be used to purchase publications for the CRES research library. A laptop computer was purchased for the CRES behavior division with a grant from an **anonymous** donor. Grants in support of the CRES Endowment Fund were recently given by the **Sahan Daywi Foundation**, the **Griffin Charitable Trust**, the **Hollis Foundation**, the **Muchnic Foundation**, and the **J. Schiro Zavela Foundation**.

Dinner with the Conservation Medalists for 2000

The first gold-filled conservation medals bearing the image of the Zoological Society's official symbol, the elephant seal, were awarded in 1966. Since that time, it has been customary to present one medal each year at a formal Society dinner. Past honorees have included Dr. Jane Goodall, H.R.H. The Duke of Edinburgh, Sir David Attenborough, Dr. Mark Plotkin, and Dr. E.O. Wilson. This year two individuals, Dr. Marilyn B. Renfree and Mr. John Aspinall, have been chosen to receive the 2000 Conservation Medal in recognition of significant achievements in the field of wildlife conservation.

Although living on opposite sides of the globe, Britain's John Aspinall and Australia's Dr. Marilyn Renfree share a deep passion for wildlife conservation. Despite poaching and political turmoil in parts of Africa, Mr. Aspinall continues his work of releasing captive-born gorillas into central Africa's mountains. At the same time, Dr. Renfree's groundbreaking research in the field of marsupial reproduction has made her the foremost authority on this subject. We are pleased Dr. Renfree will be the keynote speaker for the evening.

Please come join us for an enjoyable evening as we honor this year's Conservation Medal recipients with cocktails and dinner hosted by the Zoological Society of San Diego.

Friday, May 12, 2000
The Prado Restaurant, Balboa Park
(formerly the Cafe Del Rey Moro)

6:30 P.M.
Hosted cocktails with Joan Embery
and her animal friends

7:30 P.M.
Seated dinner

Program by
Dr. Marilyn B. Renfree

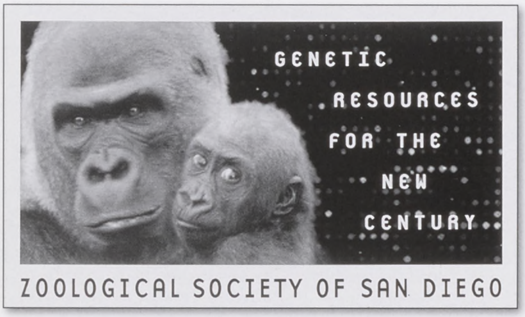
Mistress of Ceremonies
Joan Embery, Goodwill Ambassador

◆

Tickets for the Conservation Award Dinner are
$60 per person. For reservations and further information,
please call (619) 231-1515, extension 4199.

Business attire • Complimentary self-parking • Limited seating

"Genetic Resources for the New Century" Benefits the Future


GENETIC RESOURCES FOR THE NEW CENTURY
ZOOLOGICAL SOCIETY OF SAN DIEGO

We anticipate that the future will benefit from more concerted and comprehensive efforts to collect and utilize genetic resources than is currently foreseen. Our medicine, agriculture, and even our understanding of ourselves and our universe will be dramatically altered during the next decades. This spring, Genetic Resources for the New Century, a major international conference on the future of tissue and genome resources, will be hosted by the Zoological Society of San Diego and its research division, CRES, from May 7 to 11, 2000. Its aim is to consider the values, benefits, means, and options for conserving the genetic heritage of life on Earth.

This conference will bring together visionary scientists from many disciplines and backgrounds to expand on this subject, examine current efforts, and explore potential mechanisms for linking biodiversity conservation with biomedical discoveries in both economic and altruistic ways. From the thoughtful presentations and progressive discussions on the future of conserving and sustaining the diversity in nature, an expanded vision for the future will be compiled and published.

For more information on this conference, visit us at: **www.sandiegozoo.org/cres/genetic_conference.html**

Celebrating the Life of Arlene Tsuru Kumamoto

April 28, 1953 – January 10, 2000

Excerpted from the eulogy delivered by Dr. Barbara Durrant on January 13, 2000, at Clairemont Emmanuel Baptist Church, San Diego, California.

What do you see in your mind's eye when you recall the first time you met Arlene? For most of us it would be her striking physical beauty and the way she met and held our eyes with hers. Now, what was your first intellectual impression? Her friends and co-workers at CRES responded to this question with the descriptors strong, poised, professional, intelligent. When we began to know her, we learned that she was also committed, tenacious, vibrant, energetic, modest, assertive, and demanding. Arlene was all these things in one compact, complex woman who knew herself more thoroughly and realistically than anyone I have ever met.

It is my great honor to escort you through her history as a conservation professional as we celebrate the life of Arlene Kumamoto. I would like to begin with a poem by Linda Ellis entitled "The Dash":

I read of a woman who stood to speak at the funeral of a friend.
She referred to the dates on her headstone from the beginning to the end.
She noted at first came the date of her birth, and spoke of the date with tears,
But she said what mattered most of all was the dash between the years.

For the dash represents all the time that she spent on this earth,
And now only those who loved her know what that time is worth.
For it matters not how much we own, the cars, the house, the cash,
What matters is how we live and love and how we spend our dash.

So think about this long and hard, are there things you'd like to change?
For you never know how much time is left, you could be a dash mid-range.
If we could just slow down enough to consider what's true and real,
Always try to understand the way that other people feel,
Be less quick to anger and show appreciation more,
Love the people in our lives like we've never loved before,
Treat each other with respect and wear a smile,
Remembering that this special dash might last only a little while.
So when your eulogy is being read with your life's actions to be rehashed,
Would you be proud of the things they say about how you spent your dash?*

There isn't enough time to review all of Arlene's scientific achievements, but here are the highlights of how she "spent her dash."

Her intellect and interest in science were nurtured by her close family. Growing up in San Francisco, Arlene was the youngest of three children. She graduated from UCSD and came to the Zoological Society in 1975 with Dr. Kurt Benirschke when they established the Center for Reproduction of Endangered Species (CRES). In those early years she was a major contributor to the classic *Atlas of Mammalian Chromosomes*, which is an encyclopedic body of work describing the karyotypes of a vast array of mammal species, many for the first time. Co-workers recount the challenges of scientific research in the rather primitive conditions at CRES. Leona Chemnick recalls that although they practiced "open bench" cytogenetics, Arlene's work was consistently of the highest quality. A relentless perfectionist, Arlene expected nothing less from those she taught and supervised. Because Arlene religiously adhered to her own high standards, her team members were inspired to dedicate themselves to excellence. Arlene's management style was to motivate by example, not intimidation.

Arlene distinguished herself as an internationally recognized authority in cytogenetics. Her numerous publications depicted the karyotypes of mammals ranging from bats to whales with a special emphasis on antelope and gazelles. She was the first to describe the karyotypes of the Chacoan peccary, the dusky footed titi monkey, the bongo, and the okapi, among many others. Arlene developed the lymphocyte culture technique for sexing California condors in the early years of the Condor Recovery Program. She spearheaded the dik-dik work in which three distinct cytotypes were discovered in the captive population, explaining the previously mystifying infertility in groups of otherwise healthy animals.

During the early 1990s, Arlene supervised the establishment of a second site for the Frozen Zoo tanks. This was a precaution to safeguard this invaluable collection with duplicate samples stored in two locations.

Arlene's scientific interests spanned the globe with her work in Paraguay with the peccary, in China for the giant panda, travels to Kenya and Namibia to collect samples from dik-diks, as well as to Oman with husband and fellow researcher Steve Kingswood, and then to London for analysis of the chromosomes of Arabian oryx. The professional development of her team at CRES was of the utmost importance. She has been described as a wonderful, patient teacher and a strict but fair supervisor.

Arlene had a vision for the future of cytogenetics at CRES. She had arranged the purchase of the imaging system that will computerize the process of karyotyping. In addition, she wanted to scan and archive the thousands of karyotypes already generated by her division. She had begun to replace handwritten records with a complex relational database that will be eventually integrated with other databases and linked with other departments for the benefit of the entire conservation effort at the Zoological Society and beyond. Arlene had plans to publish a number of scientific papers representing completed research. It is sometimes overwhelming for Arlene's team to contemplate making her vision a reality without her guidance and knowledge, but I know she had prepared them well and they will carry her torch into the future.

** Note: Pronouns in poem have been changed to feminine gender here.*

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Girl Scouts Recycle for CRES

Tamara Langmead

San Diego Zoo educator Robin McLaughlin presents Sinbad the macaw to scouts at the Girl Scouts Cans for Critters Jamboree last November.

Hats go off to the 1,958 Girl Scouts who participated in the Second Annual Girl Scout Cans for Critters Drive. A total of 165 troops joined the recycling drive and collectively recycled 10,362 pounds of aluminum equal to 331,590 cans! More than 1,000 badges were awarded to those Girl Scouts who collected 200 or more cans. Participants were thanked and top collectors honored at the Girl Scout Jamboree on November 13, 1999. San Diego Zoo animals and educators, along with the Jammin' Z90 bus, visited the scouts at the Girl Scout headquarters located on Upas Street. The proceeds from the recycling were donated to CRES. If your troop, school, or organization would like to be a part of the Cans for Critters recycling program, please call Tamara Langmead at (619) 744-3362.

cans for critters®

C·R·E·S REPORT
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